

REMARKS/ARGUMENT

Claims 1 and 15 have been amended to require Si content of 0.70 to 3%. Support for this limitation exists, *inter alia*, at par. [0015] of the present application.

Claims 1 and 15 have also been amended to require the formation of a solid solution of Si in ferrite. Support for this limitation exists, *inter alia*, at par. [0030] of the present application.

The dependency of claim 14 has been changed.

Claims 1-18 are currently pending.

The Office Action rejected the pending claims under 35 U.S.C. § 103 as obvious over JP 2000-337333 (“Ibaraki”) in view of U.S. patent application publication no. 2002/0179207 (“Koike”). In view of the following comments, Applicants respectfully request reconsideration and withdrawal of this rejection in view of the following comments.

The pending claims all require, among other things, the presence of (1) 0.51-2.5% Cr; and (2) at least 0.70% Si; and (3) bluing treatments. Thus, the pending claims cover those bolts having improved relaxation resistance properties, but exclude those bolts which do not (bolts containing less than 0.51% Cr, less than 0.70% Si and/or which do not undergo bluing treatments).

The high-strength of the present invention is prepared by wire-drawing a bolt steel containing, among other ingredients, 0.70 to 3% Si, 0.51 to 2.5% Cr, proeutectoid ferrite, proeutectoid cementite, bainite and martensite at a total areal rate of less than 20% and pearlite in balance; cold-heading the wire into a bolt shape; and then subjecting the bolt comprising 0.70 % to 3% Si to a bluing treatment in a temperature range of 100 to 500°C to form a solid solution of Si in the ferrite. By subjecting the bolt containing 0.7-3% Si to the bluing treatment, the relaxation resistance of the bolt is significantly improved (as compared to a bolt not subjected to bluing treatment and/or containing less than 0.55% Si). (See, pars. [0045] and [0046], and Fig. 4 of the present application).

Moreover, because the Si is solid-solubilized in the ferrite in the present application, the relaxation resistance of the bluing treatment is enhanced. (See, pars. [0015] and [0030] of the present application).

Ibaraki neither teaches nor suggests this invention. Significantly, as recognized by the Office Action, Ibaraki does not teach or suggest a bluing treatment.

Furthermore, Ibaraki teaches (1) warm-forging a steel wire, (2) Si content to be preferably less than 0.5% (since high Si content reduces ductility of the steel wire – see, par. [0018]), and (3) an area rate of pearlite of preferably 100% (see, par. [0012]), meaning that ferrite preferably does not exist so that a solid solution of Si in the ferrite is not formed.

Finally, Ibaraki teaches away from steel containing more than 0.5% Cr -- Ibaraki teaches that Cr exceeding 0.5% reduces delayed fracture resistance and toughness. (See, for example, par. [0020]).

One of ordinary skill in the art, following Ibaraki, would be led away from the present invention for at least the reason that Ibaraki would lead to a steel product having improved relaxation resistance properties which is warm-forged, has too little Si, has too little Cr, does not undergo a bluing treatment and/or does not form a solid solution of Si in the ferrite.

Koike cannot compensate for Ibaraki's many fatal deficiencies.

Koike, at pars. [0025]-[0026], expressly limits Si content to 0.5%. In this regard, Koike explains that "the excessive Si content is likely to lower the ductility as well as the cold heatability of the steel wire," and then indicates that preferred Si content is 0.1% or 0.05%. (Par. [0026]). Furthermore, comparative example F in Koike contains 0.89% Si. Table 3 (test no. 8) indicates that this sample "cracked," and thus was unacceptable. The clear teaching of Koike was that Si content greater than 0.5% was unacceptable and should not be used, particularly when cold heading is performed. Stated another way, Koike actually teaches away from cold heading when Si content is greater than 0.5%. Given that Ibaraki is directed to warm-forging, the combination of these references cannot lead to cold heading a product containing 0.7-3% Si and, thus, cannot lead to the present invention.

Furthermore, Koike, like Ibaraki, teaches that an area rate of pearlite is preferably 100% (see, par. [0018]), meaning that ferrite preferably does not exist so that a solid solution of Si in the ferrite is not formed. Thus, the combination of the applied art would not lead one of ordinary skill in the art to the claimed invention in which the Si is solid-solubilized in the ferrite.

Also, like Ibaraki, Koike is fatally deficient because it teaches away from steel containing more than 0.5% Cr -- Koike teaches that Cr exceeding 0.5% does not further reduce proeutectoid cementite. (See, for example, pars. [0034]-[0035]). Thus, Koike would not motivate one of ordinary skill in the art to ignore Ibaraki's express teaching to use less than 0.5% Cr. In other words, the combination of applied references would not lead to a steel product having the required Cr content and, thus, cannot constitute the basis for a proper rejection given that one of the required elements is lacking from their combination.

Finally, Ibaraki (at par. [0039]) teaches that warm forging is used because it is difficult to form a bolt of a prescribed shape using cold forging. Thus, Ibaraki (expressly limited to warm forging) and Koike (limited to cold forging) are not properly combinable: that is, given Ibaraki's express limitation to warm forging, one of ordinary skill in the art would not have been motivated to modify Ibaraki's teachings related to warm forging using Koike's cold forging techniques.

Given the many identified deficiencies of the applied art, one of ordinary skill in the art would not have produced invention bolts having improved relaxation resistance properties. Instead, the art would be without such bolts. It is only because the present inventors went directly against the disclosures of the applied art that they were able to discover bolts having the improved relaxation resistance properties of the present invention.

In sum, the applied art would not have motivated one skilled in the art to arrive at the claimed invention requiring require the presence of (1) 0.51-2.5% Cr; and (2) at least 0.70% Si; and (3) bluing treatments, but rather would have led one skilled in the art away from it. Under such circumstances, the claimed invention cannot be obvious.

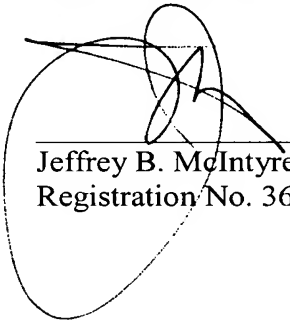
Application No. 10/591,475  
Response to Office Action dated June 16, 2009

In view of the above, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103.

Applicants believe that the present application is in condition for allowance. Prompt and favorable consideration is earnestly solicited.

Respectfully submitted,

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